

been the mapping and description, and probably, eventually, the care of the national forest reserves. This opens up a new branch of work in which temperature, rainfall, wind, and other meteorological conditions must be considered.

On page 116 of Mr. Walcott's report as director he states:

The preparation of a physical atlas of the United States, upon which much work had been done in former years, was continued. Climatic maps were prepared, which include maps of mean monthly temperature, of annual pressure, cloudiness and snowfall, monthly and annual maps of relative humidity, and maps showing the range in temperature between the hottest and coldest months; in all 28 maps. Besides these diagrams have been prepared of the slopes of the rivers of the United States.

As nearly all the climatic data for the United States is preserved in the archives of the Weather Bureau, it would seem that the climatic maps prepared by the Geological Survey must be essentially the same as those prepared by the Weather Bureau. There are, undoubtedly, frequent inquiries for a physical atlas and, so far as meteorological elements are concerned, the Weather Bureau has furnished its data freely to all inquirers and has published that for which there seemed to be the greatest demand. Plans for a national physical atlas were submitted by Prof. Joseph Henry in 1847 for publication by the Smithsonian Institution. An atlas of this character was published by Gen. Francis A. Walker, in connection with the census of 1870, to which, at the suggestion of the present writer, the Weather Bureau contributed four meteorological charts. When Mr. Gannett was assigned to duty in the Census Bureau as geographer, in addition to his duties as Topographer in the Geological Survey, many climatic charts were prepared by him for the publications of the census of 1880, and a revision of these was begun for the eleventh census of 1890. It is evident that by the proper cooperation of the Weather Bureau (as to meteorology and hydrology), the Geological Survey (as to topography, hydrography, seismology, geology, and mineral springs), the several divisions of the Department of Agriculture (as to soils and forests), and the Coast and Geodetic Survey (as to magnetism, terrestrial gravity, and tides), our national government is now in a position to prepare a physical atlas of the United States, embracing every branch of terrestrial physics. An atlas that does not embrace all these must, necessarily, be incomplete and more or less unsatisfactory. A joint work for which each Department of the Government assumes the proper responsibility would respond to a recognized desideratum.

RECENT EARTHQUAKES.

Prof. Edward W. Morley, of Adelbert College, Cleveland, Ohio, and Prof. C. F. Marvin, of the Weather Bureau at Washington, report that no earthquakes have been recorded on their respective seismoscopes during December.

December 2.—Medicine Lodge, Kans.: about 12:45 a. m. a slight shock was experienced in this locality. Duration, about five seconds; direction, south to north. Rome, Kans.: about 1 a. m. Jefferson, Okla.: at 1:10 a. m. an earthquake shock, quite severe; rocked buildings, making them creak and crack; the disturbance seemed to be from northwest to southeast.

December 6.—Forest Grove, Oreg.: slight shock at 8:30 p. m.

December 15.—Waterville, Wash.: earthquake; duration four to six seconds; direction, northwest to southeast. Lakeside, Wash.: A severe shock.

December 15.—At 6:43 a. m., local time, severe earthquake, causing great damage throughout San Domingo. A second slight movement at 2 p. m. Churches and buildings were destroyed and railroad traffic interrupted. The submarine cable to Hayti was also affected. The grand edifice of Santo Cerro, in Santiago, in the interior of San Domingo, dating from the time of Columbus, was entirely destroyed. A con-

tinued repetition of harmless shocks occurred until the end of the month.

December 16, 17, 20.—Lakeside, Wash.: light shocks, all occurring at 6 a. m., vibrating from west to east.

December 18.—Earthquakes were reported at Ashland, Va., 6:54 p. m.; slight shock, with heavy rumbling noises, lasting from twenty to thirty seconds. Richmond, Va.: Shortly before 7 p. m. earthquake noticeable everywhere, but more violent in the eastern part of the city, toward Oakwood. At Oakwood it was heard and felt very distinctly. At Bonair and throughout Henrico County, Va., it was heard and felt; also at Buckingham and Maidens at 6:49 p. m., and at Fredericksburg.

December 26.—Centerville (P. O. Niles), Cal.: earthquake 7:06 a. m.; duration, five seconds; direction, north to south.

December 29.—Cockburn Town, Grand Turk, W. I.: Mr. Geo. J. Gibbs reports:

On the morning of Wednesday the 29th day of December, 1897, at about 6:37 o'clock a. m., a slight shock of earthquake was felt at the Island of Grand Turk, lasting a few seconds. No damage was done; it was sufficiently strong, however, to stop the movement of the Government clock at the public buildings, and also several other timepieces in this town; symptoms of nausea were experienced by some of those who felt the trembling of the earth.

ELECTRIC STORMS AT SACRAMENTO.

The cause of the electrification of the atmosphere, from which follows the electrical phenomena of the thunderstorm, will, of course, not be understood until we have been able to explain how it happens that in some sections of the world there are so few thunderstorms, while in others they are of almost daily occurrence. A portion of California is singularly free from lightning, as shown by the following compilation from the records of the Weather Bureau station at Sacramento. The Weather Bureau station at this place was opened July 1, 1877, and the daily journal kept at the station probably affords a complete list of all the thunderstorms (viz, even a slight display of thunder or lightning) that have occurred. The following is the complete list of dates as corrected and continued from the list published on page 105 of Mr. Barwick's Monthly Bulletin of the California Weather Service for June, 1893:

1877.—July 20.

1878.—January 22; March 20; May 28; August 15.

1879.—March 30; April 4, twice; May 25; October 7.

1880.—March 3; June 11; July 25.

1881.—April 9, 21; May 23; June 3.

1882.—March 15; June 14; July 3; September 15.

1883.—March 27; May 6.

1884.—May 17, 18, 19.

1885.—April 2, 7, 8; September 5, 6; October 6.

1886.—January 20; March 4; April 9.

1887.—May 30; September 22; November 5.

1888.—May 12, 13; September 14, 15, three storms.

1889.—March 10, 20; April 2; October 8, 21; November 18.

1890.—February 16; May 10; December 3.

1891.—February 22; April 13; May 18; September 5.

1892.—September 26, 29, 30.

1893.—March 11; May 17; September 6.

1894.—May 25; June 17.

1895.—April 27; June 28; October 11.

1896.—May 27.

1897.—August 18, 19; December 1.

In most cases the display of lightning and thunder was very slight. The following notes refer to interesting cases:

1885, October 6, forked lightning occurred in the shape of a horseshoe.

1887, September 22, brilliant and long flashes of zigzag or forked lightning.

1888, September 14, 15, there were five distinct and severe storms with lightning and thunder in the vicinity of Sacramento during these two days.